



# Perfluoro-what? PFAS and Persistent Contaminants in Our Lakes

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# What are “emerging” contaminants and how do they impact NH Lakes?

“**Emerging contaminants**” are those that either have limited information about health and ecological risks, or their occurrence in the environment is poorly understood.

This lack of information limits the ability to regulate and direct resources to address these contaminants.

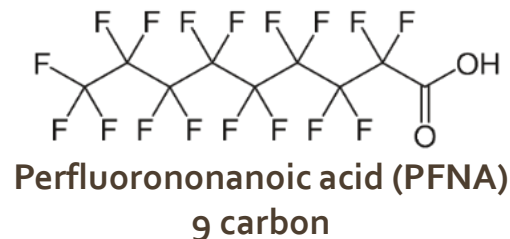
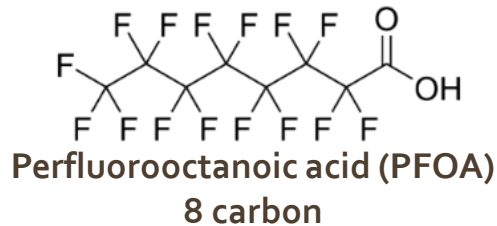
Examples of emerging contaminants include:

- **Per- and polyfluoroalkyl substances (PFAS)**
- Microplastics
- Personal care products and pharmaceuticals (e.g., drugs, antibiotics, and UV filters)
- Novel cyanobacteria and algae blooms
- Nanomaterials
- “Re-emerging” contaminants – Polychlorinated biphenyls (PCBs), lead (Pb), heavy metals, dioxins

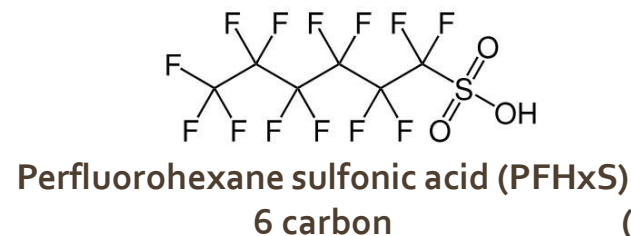
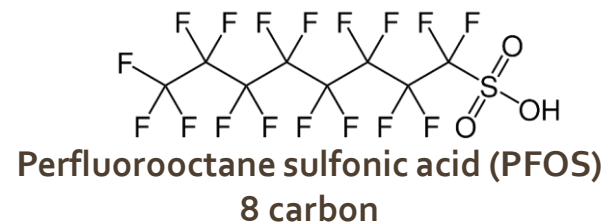
# What the F (Fluorine) are PFAS?

- “**PFAS**” stands for **Perfluoroalkyl & Polyfluoroalkyl Substances**.
- > 4,000 compounds, formerly called *Perfluorochemicals* (PFCs).
- Different functional groups & carbon-chain lengths determine names.
- Short- (<5-6 carbons) versus Long-chain (>5-6 carbons)

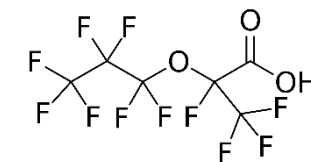
## Perfluorocarboxylic Acids (PFCAs)



## Perfluorosulfonic Acids (PFSAs)



## “Other” PFAS



HFPO-DA

(2,3,3,3-Tetrafluoro-2-(heptafluoropropoxy)propanoic acid)

How are PFAS used in society?



# How are PFAS used other Industrial and Commercial Products?

## Industrial Applications

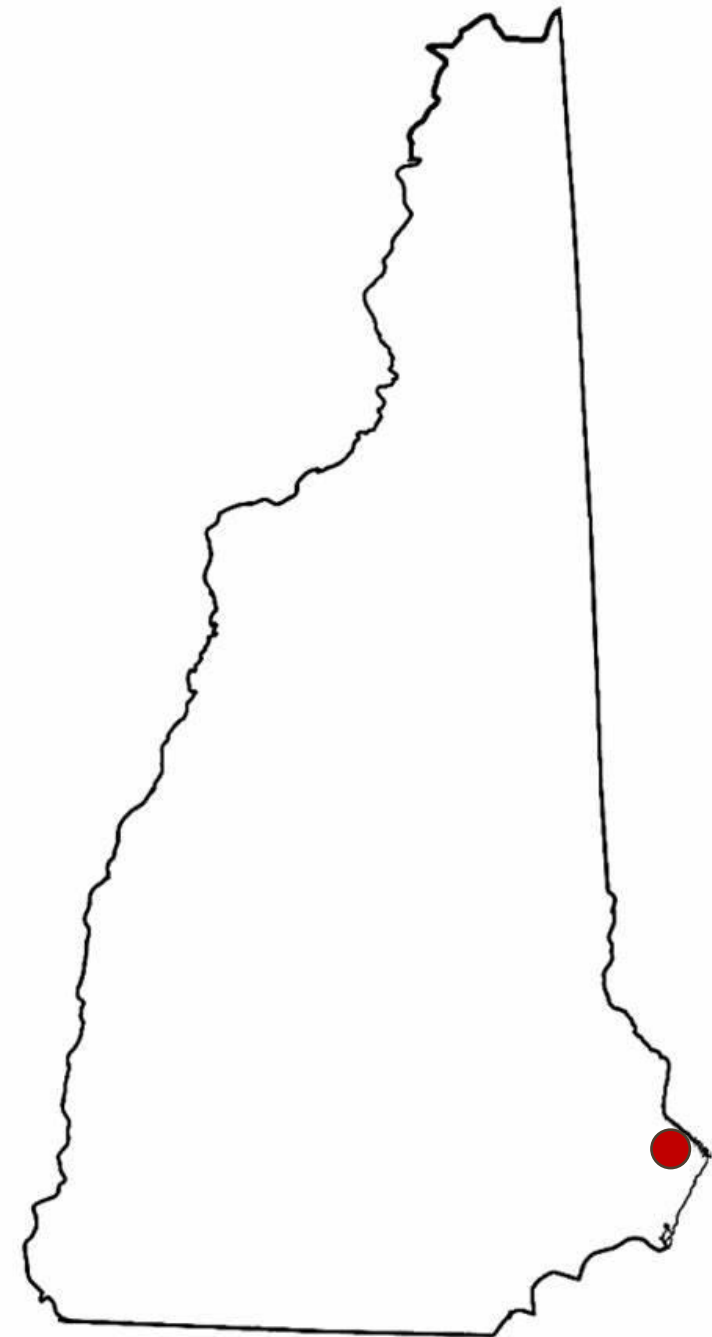
- Aqueous Film-Forming Foam (AFFF)
- Chemical production
- Metal plating
- Textiles, upholstery, apparel, carpets
- Paper and packaging
- Rubber and plastics
- Medical devices
- Insect baits
- Semiconductor manufacturing
- Photoimaging

## Commercial Products

- Non-stick cookware
- Fast food containers
- Candy wrappers & microwave popcorn bags
- Personal care and cosmetic products
- Paints and varnishes
- Stain-resistant carpet and chemicals
- Water-resistant apparel
- Cleaning products
- Electronics
- Ski wax

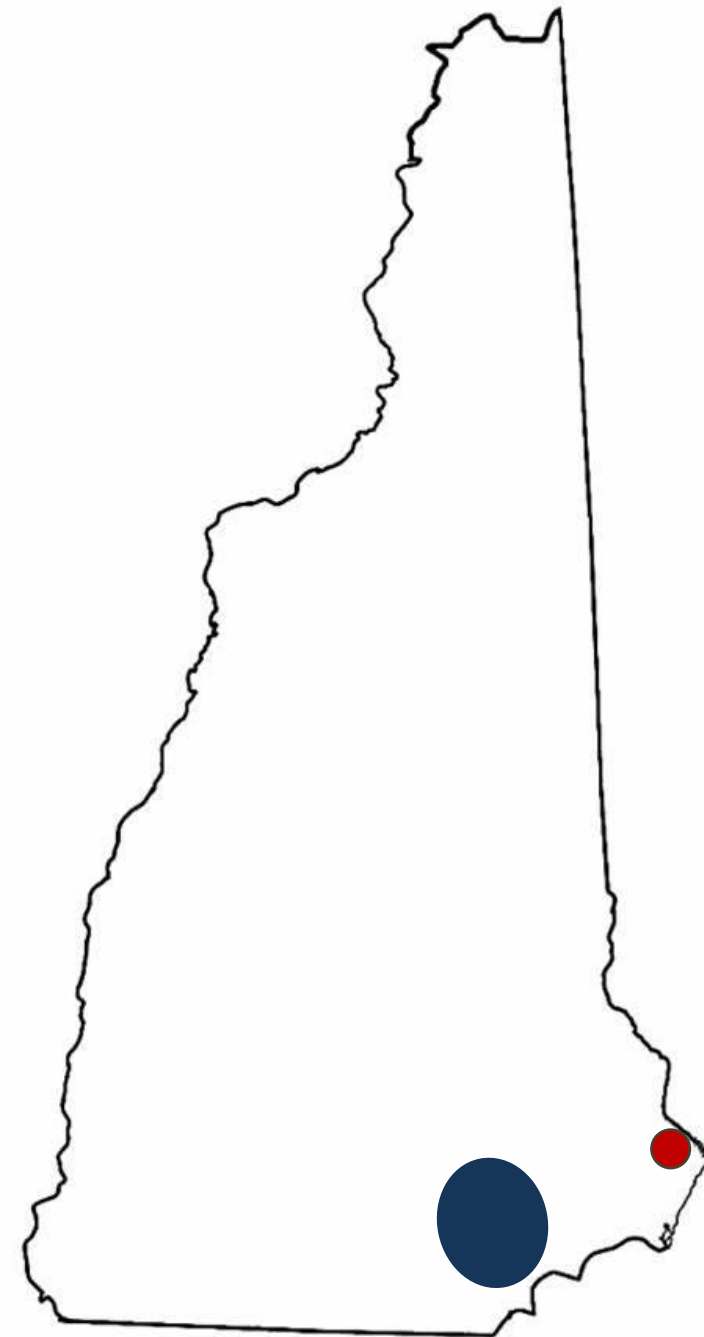
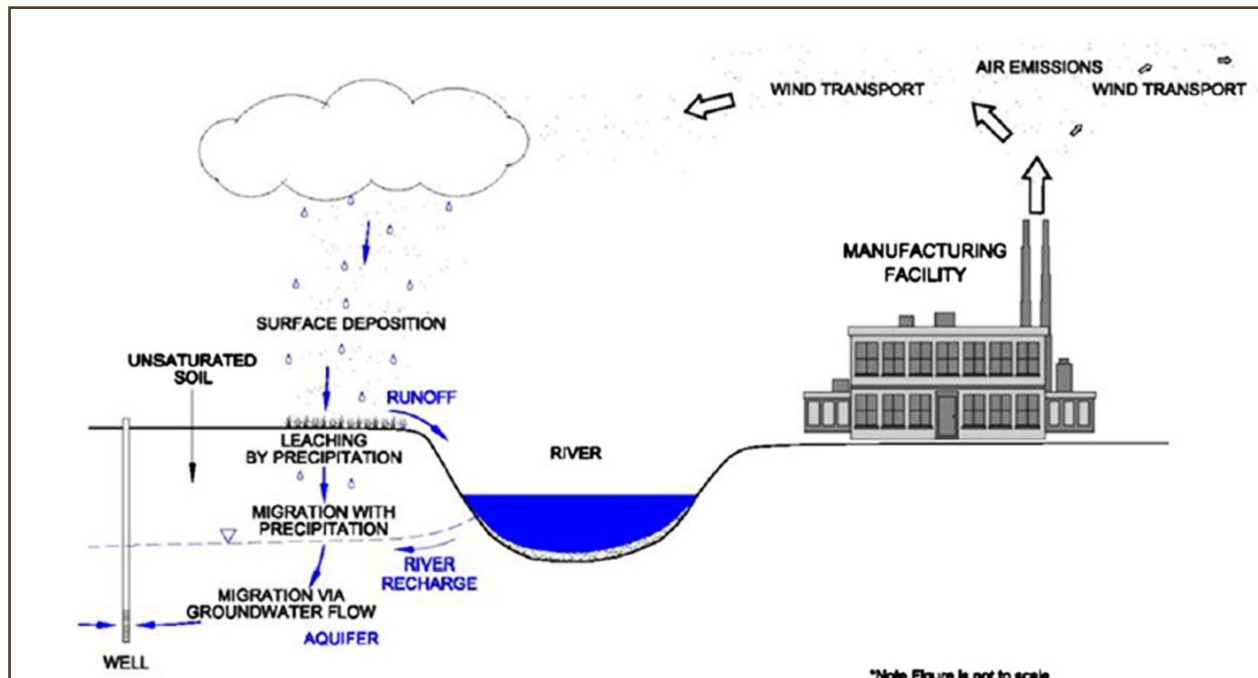
# PFAS & New Hampshire

Aqueous Film Forming Foam (AFFF) at the  
**former Pease Air National Guard Base** (2014)



# PFAS & New Hampshire

Industrial air emissions from facilities in  
**Merrimack and Southern NH** (2016)



# ***PFAS Impacts are Present Throughout New Hampshire***

Updated: April 11, 2022

## **PFAS SAMPLES**

Data in NHDES' Environmental Monitoring Database (EMD) ~ 18,651 samples

- PFOA+PFOS > 70 ppt
- PFAS > AGQS / MCL
- PFAS ≤ AGQS / MCL

## **PFAS SITES**

Data in NHDES' Onestop Database ~ 484 sites

- ★ Site with PFAS > AGQS
- ★ Site with PFAS Detections
- ★ Site with PFAS Screening  
No Detections

- Political Boundary
- Major Waterbody
- Conservation Land

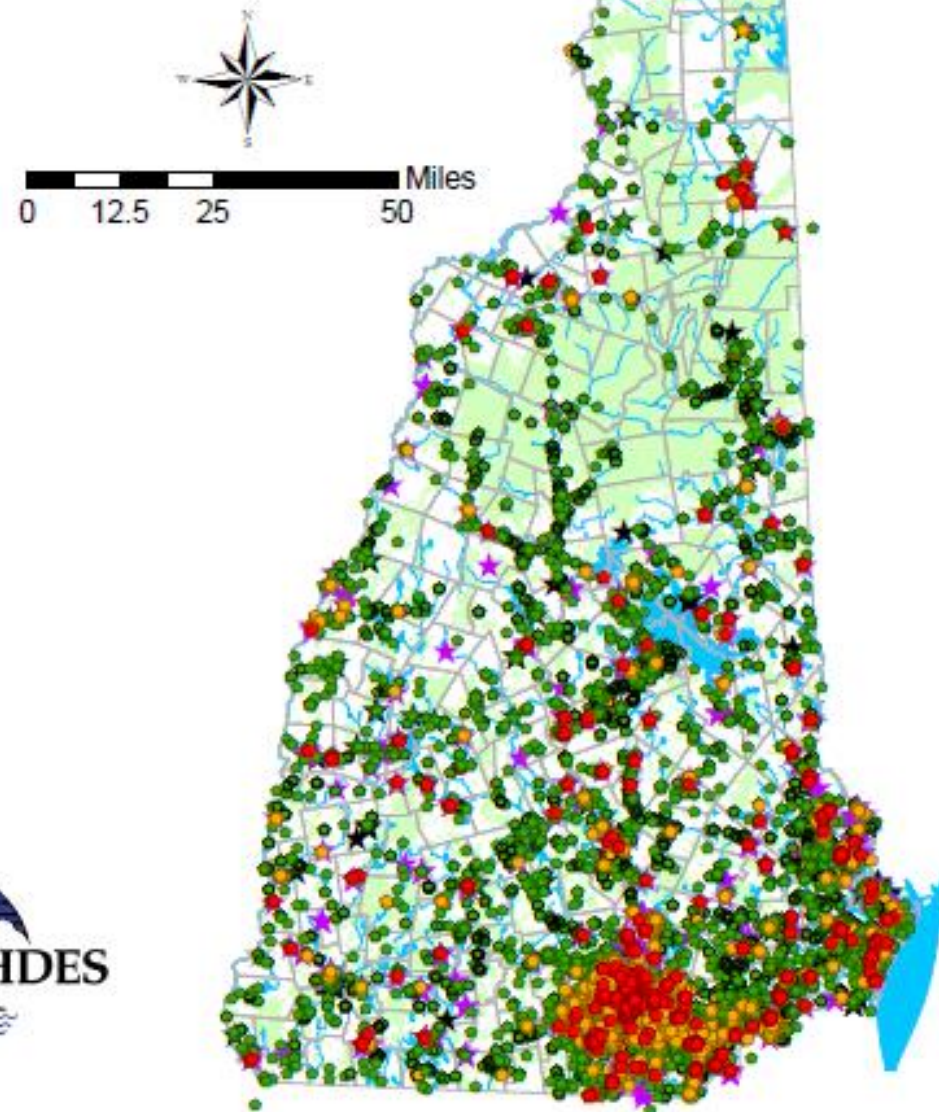
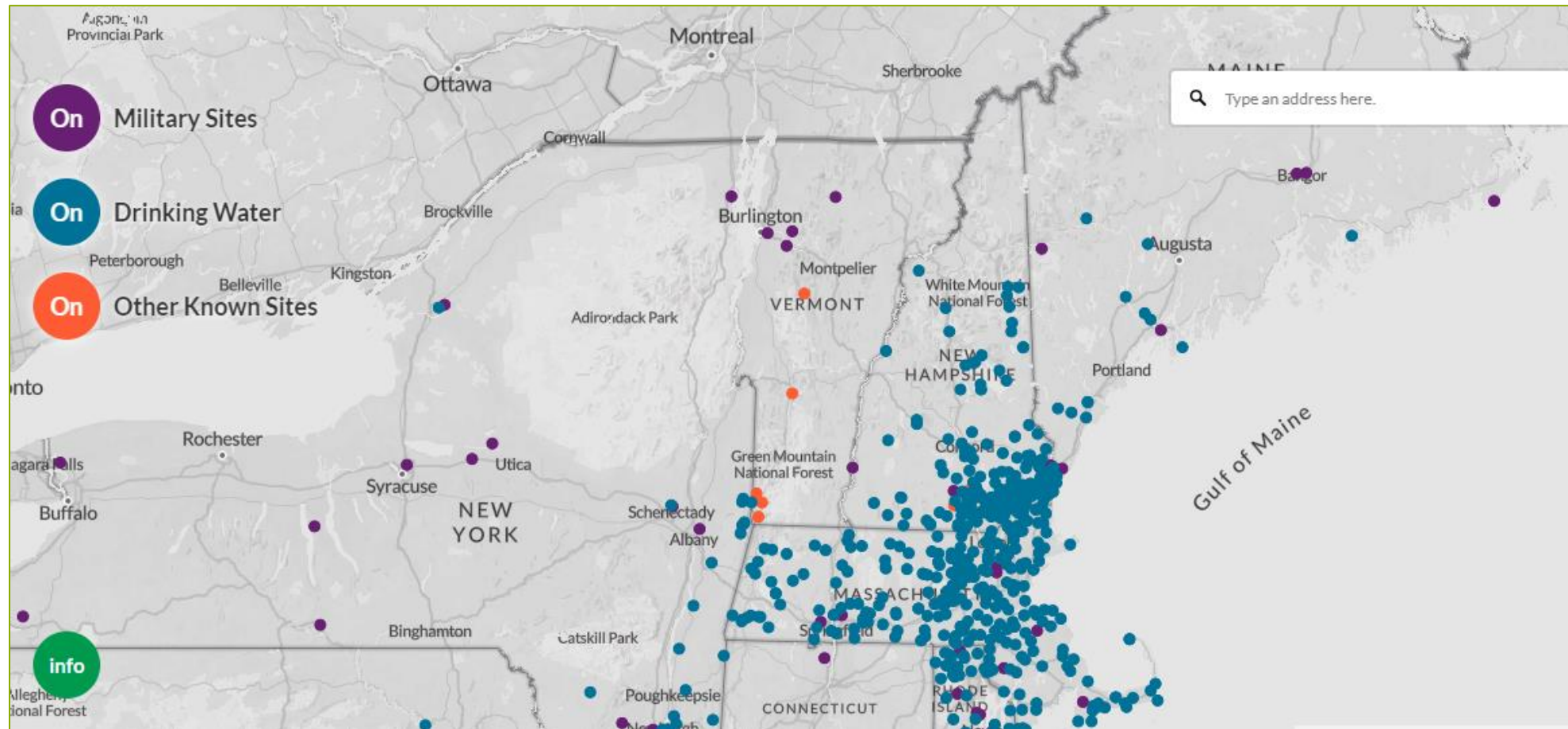


Image Courtesy of Derek  
Bennett, Administrator, NHDES  
Drinking Water Quality Program

# Other New England States



Source: Environmental Working Group (EWG) PFAS Mapper, 2022

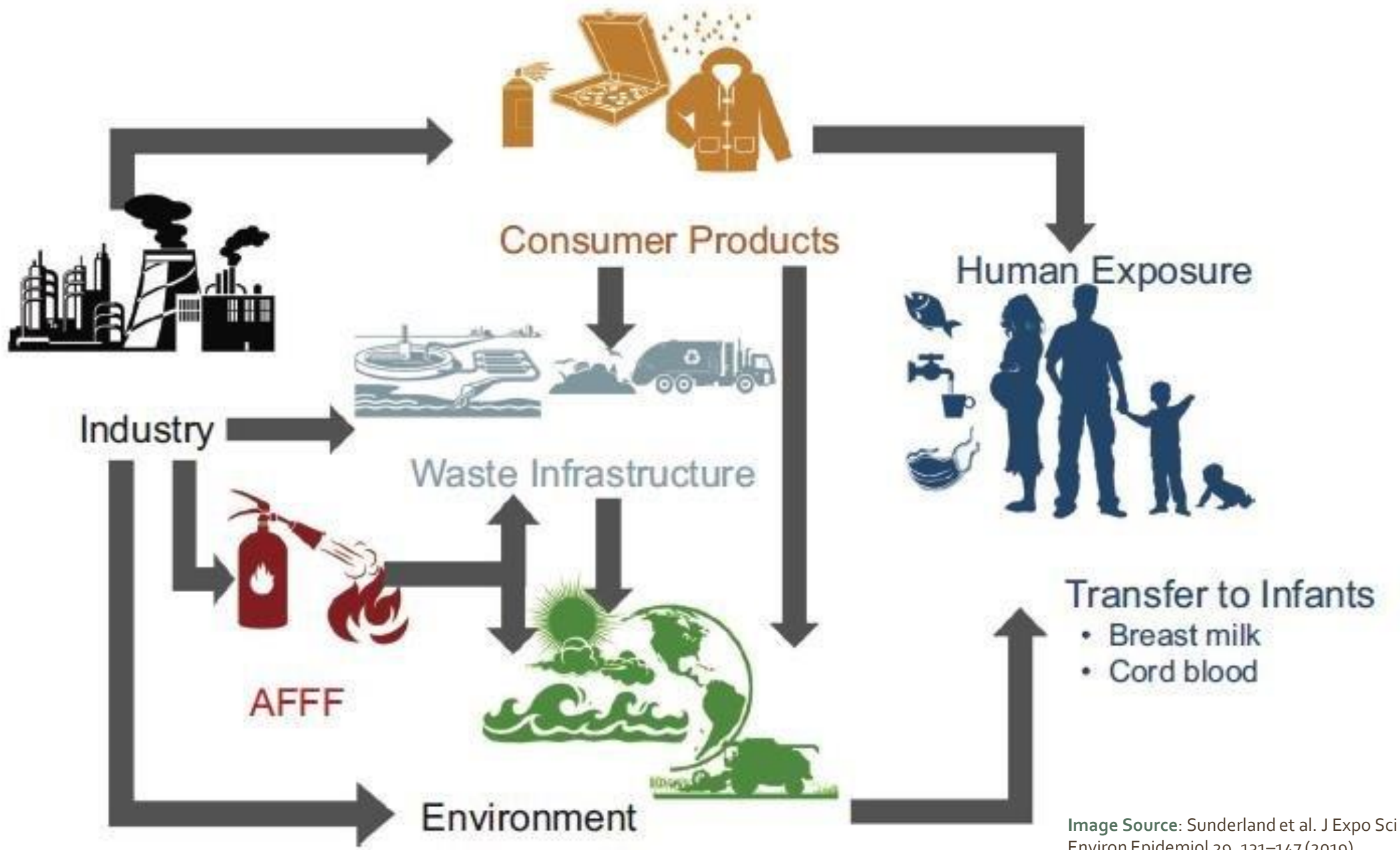
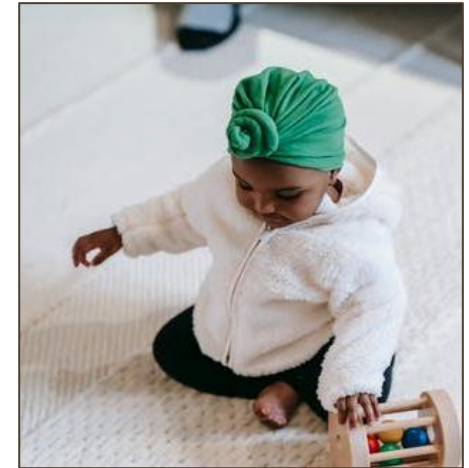


Image Source: Sunderland et al. J Expo Sci Environ Epidemiol 29, 131–147 (2019).

# How are you exposed to PFAS?

- **Primary route of exposure is ingestion** (e.g. drinking water or food).
- Certain PFAS transfer from the placenta/breastmilk to infants.
- Inhaling/ingesting PFAS-containing dusts may contribute to exposure.
- Certain PFAS are **less efficiently absorbed across the skin**.
- **Certain PFAS are bioaccumulative**, meaning they “build-up” in the body.



# Health Risks Associated with Per- and Polyfluoroalkyl Substances (PFAS)

- ↑ cholesterol levels
- ↑↓ in liver enzyme levels
- Small ↑↓ in infant birth weight
- ↑↓ immune system function
- ↑ risk of high blood pressure or pre-eclampsia in pregnant women
- ↑↓ in thyroid and/or reproductive hormones
- Possibly ↑ risks for kidney or testicular cancer

These health outcomes are being studied nationwide by the Agency for Toxic Substances and Disease Registry (ATSDR), as well as by private and academic institutions.

This is a *constantly evolving area of scientific research*. For more information from ATSDR, follow this link: <https://www.atsdr.cdc.gov/pfas/index.html>

# What's the PFAS profile in certain NH Lakes?

- We know PFAS can **“bioaccumulate”** into fish and other aquatic organisms.
- This occurs through **interaction with water, sediment and prey.**
- Animals, including humans, that eat fish may have exposure to PFAS.

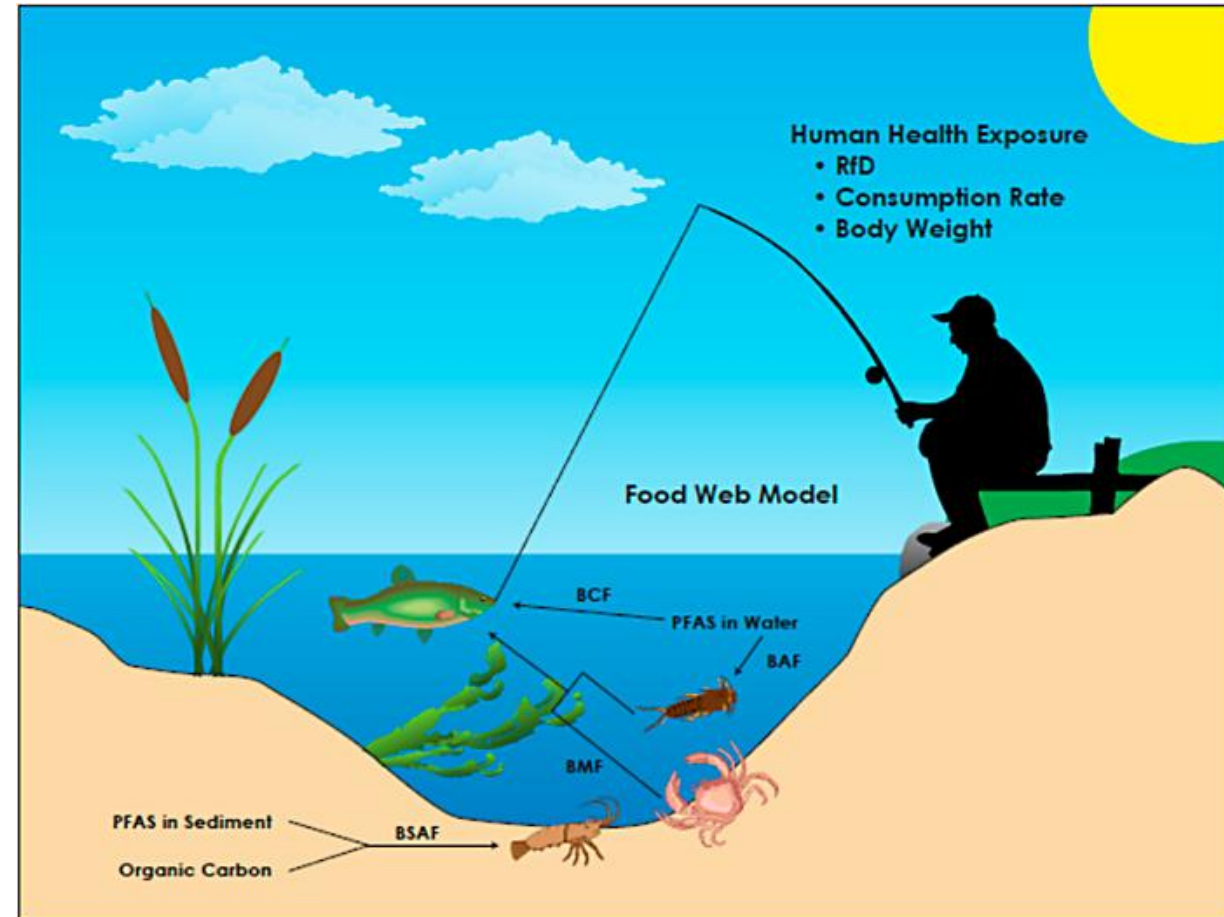


Diagram Source: Interstate Technology & Regulatory Council's PFAS Technical & Regulatory Guidance Document (Figure 17-1; <https://pfas-1.itrcweb.org/>)

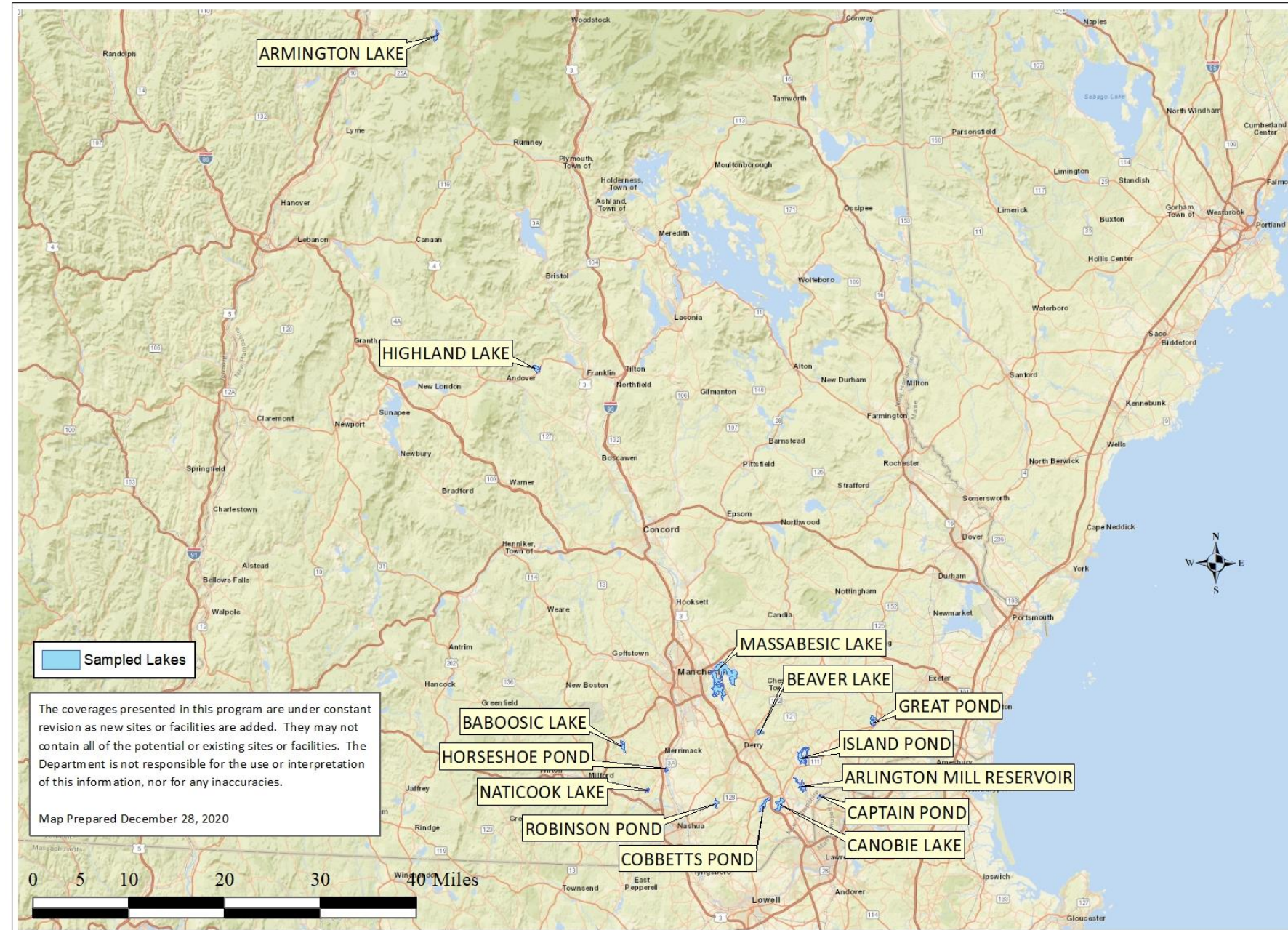
## Lakes in the Fall 2020 PFAS Sampling

### Study Lakes in Southern NH

1. Arlington Mill Reservoir, Salem
2. Baboosic Lake, Merrimack
3. Beaver Lake, Derry
4. Big Island Pond, Derry
5. Canobie Lake, Salem
6. Captain Pond, Salem
7. Cobbetts Pond, Windham
8. Great Pond, Kingston
9. Horseshoe Pond, Merrimack
10. Lake Massabesic, Auburn
11. Naticook Lake, Merrimack
12. Robinson Pond, Hudson

### Reference Lakes

13. Highland Lake, Andover
14. Armington Lake, Piermont



# What's the PFAS profile in certain NH Lakes?

Objective of this study was to learn about the occurrence of certain PFAS in southern NH waterbodies.

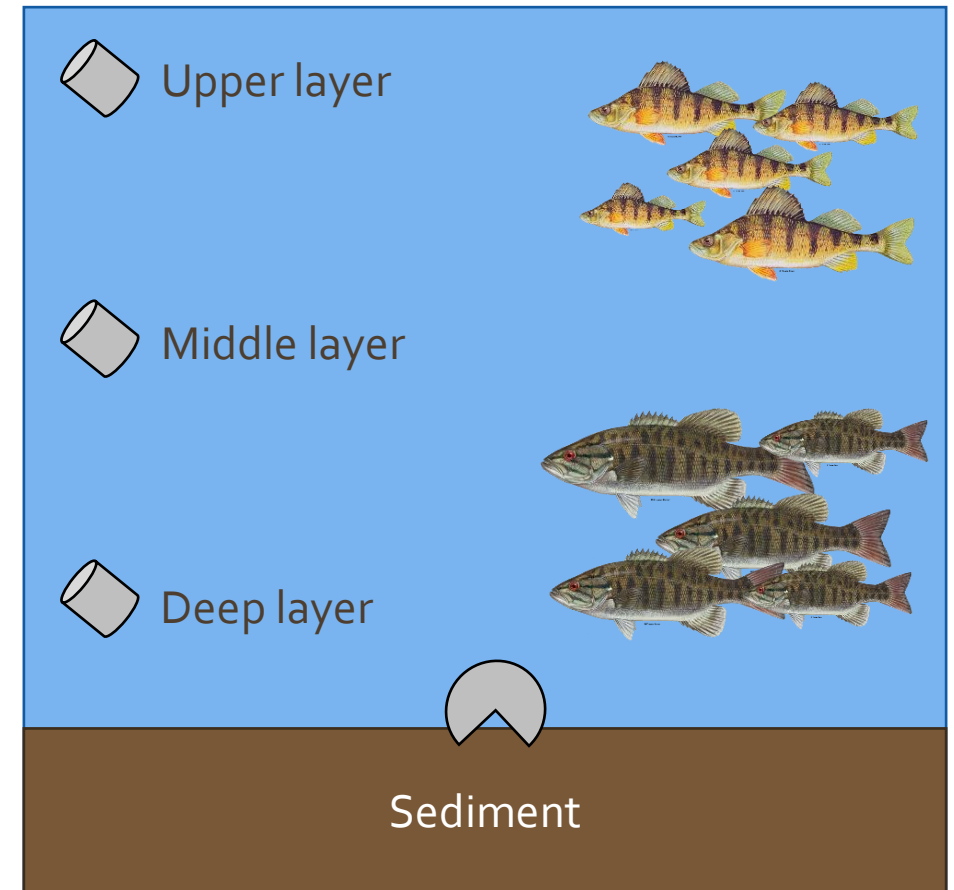
**14 waterbodies in NH** sampled in October 2020

**Water samples** at 3 depths and **1 sediment sample** were also collected at each lake.

- Analyzed at Eurofins for 36 PFAS

**2 fish species** were composite sampled at each waterbody

- 5 individual fish were combined to make 1 sample
- Analyzed at SGS-AXYS for 34 different PFAS

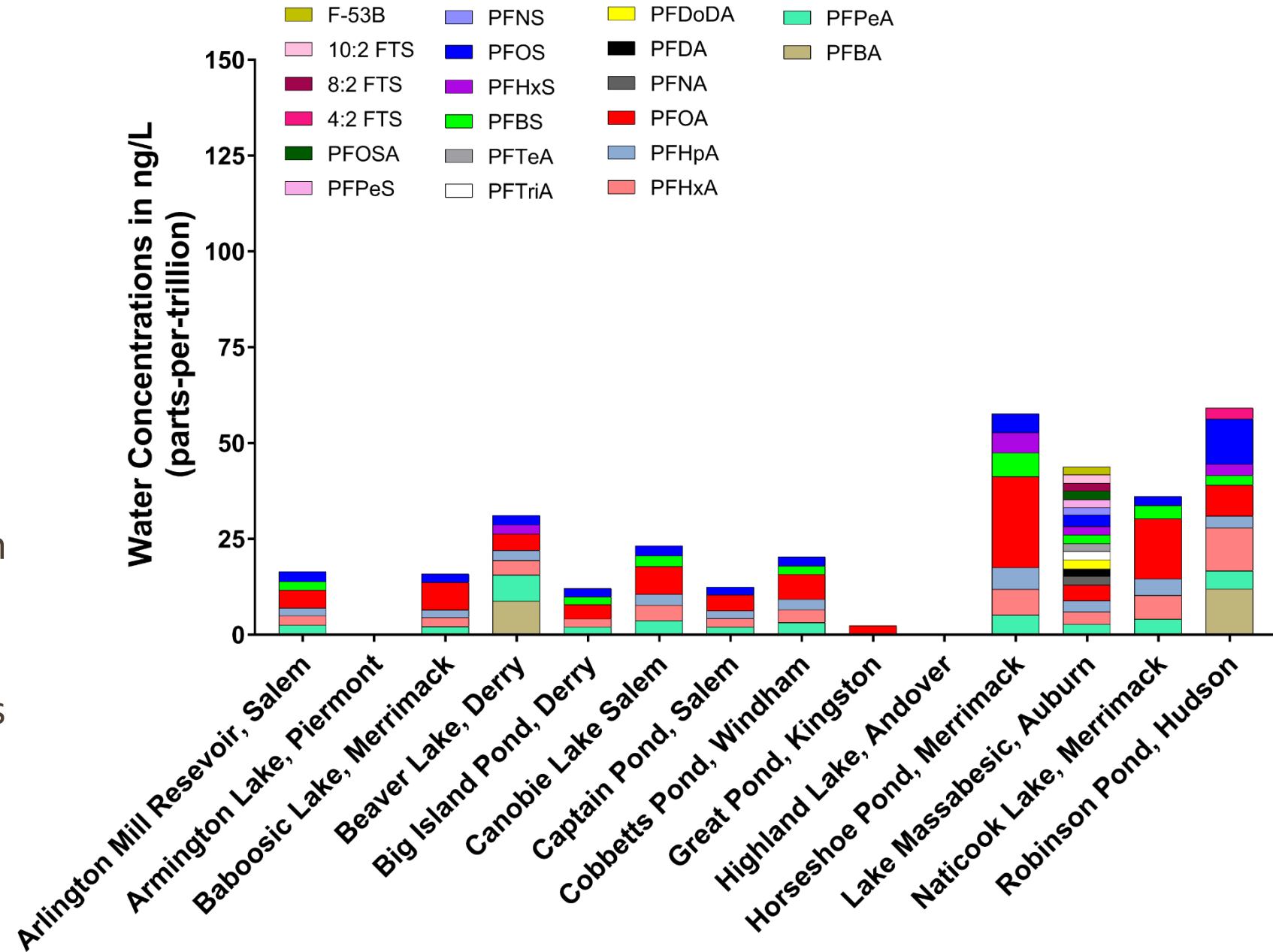


Fish images: U.S. Fish & Wildlife. 2020.

<https://www.fws.gov/fisheries/freshwater-fish-of-america>. Accessed 4/22/2020.

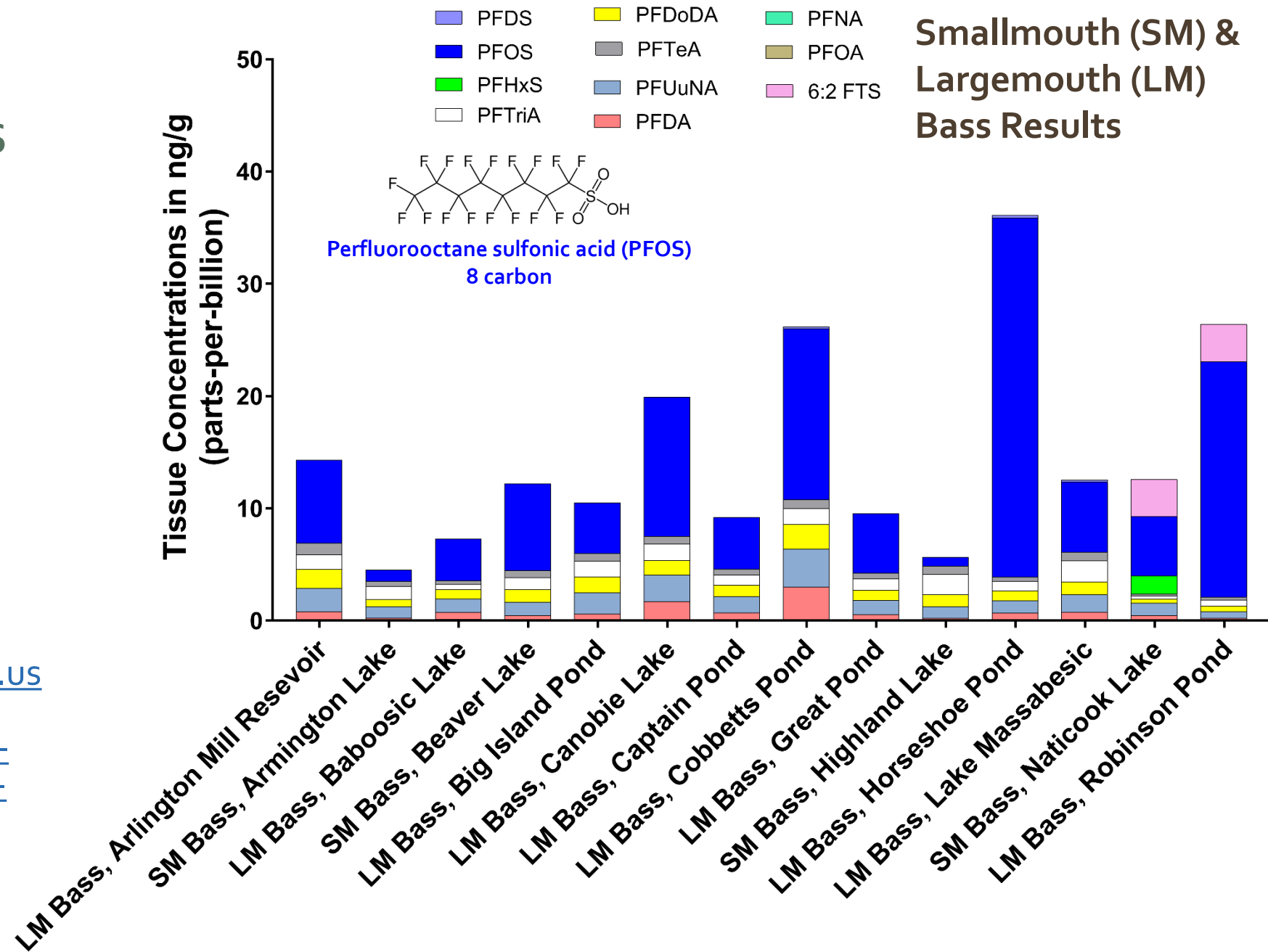
# Water & Sediment Results

- PFAS are present in NH lakes.
- They occur as mixtures, likely due to multiple sources.
- Less frequently detected in sediments using currently analytical chemistry.
- Some analytical challenges complicate testing.

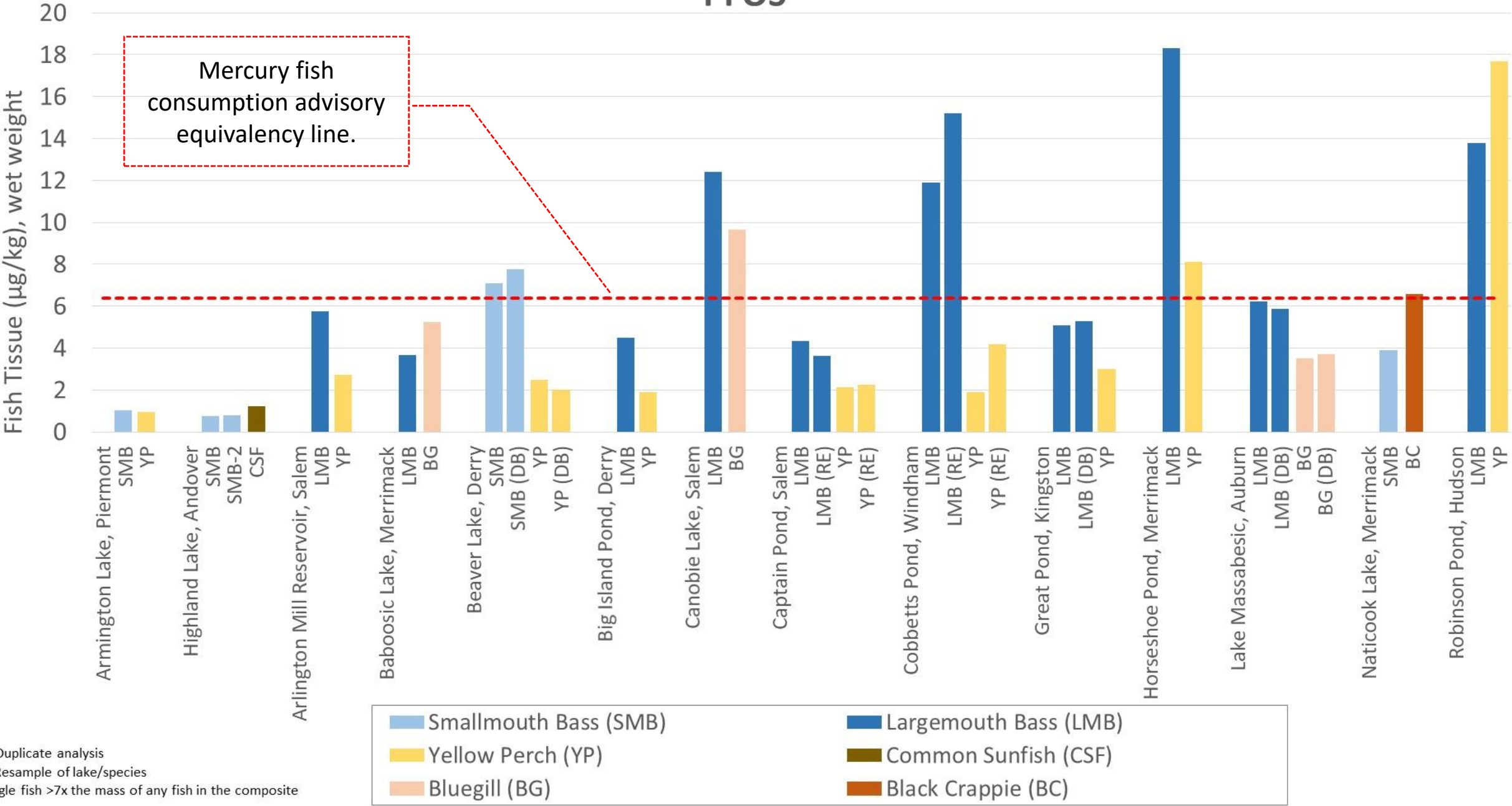


# Fish Tissue Results from Bass Species

- PFAS are present in fish sampled from all lakes.
- Again, PFAS occur as mixtures but different than water.
- PFOS is the most common and abundant PFAS in fish.
- Result for other species are available in the Full Report: <https://www4.des.state.nh.us/nh-pfas-investigation/wp-content/uploads/2020-lake-fish-water-sediment-PFAS-report.pdf>



PFOS



# Recommended Additional Advisories Above and Beyond the State-wide Mercury Advisory

Lake	Species	Population Segment CBA = Childbearing Age	Recommended Maximum Consumption Rate (meals/month)
NH <u>Statewide</u> Mercury Advisory	Most Species	Typical Adult	4 meals/month
		Women CBA & Children	1 meal/month
Derry, Beaver Lake	Bass Species	Typical Adult*	3 meals/month
		Women CBA & Children	1 meal/month (same as Hg)
Salem, Canobie Lake	All Species	Typical Adult*	3 meals/month
		Women CBA & Children	1 meal/month (same as Hg)
Windham, Cobbetts Pond	Bass Species	Typical Adult*	2 meals/month
		Women CBA & Children	1 meal/month (same as Hg)
Merrimack, Horseshoe Pond	All Species	Typical Adult*	1 meal/month
		Women CBA Children**	1 meal/month (same as Hg) DO NOT EAT
Hudson, Robinson Pond	All Species	Typical Adult*	2 meals/month
		Women CBA Children**	1 meal/month (same as Hg) DO NOT EAT

# Words of Caution

- Small sample sizes and composite sampling of fish tissue.
- Sampling is biased to South Central NH, not representative of the state.
- Risk of total PFAS is unknown.
- Other contaminants are present.
- Relative risks versus benefits of fish consumption.

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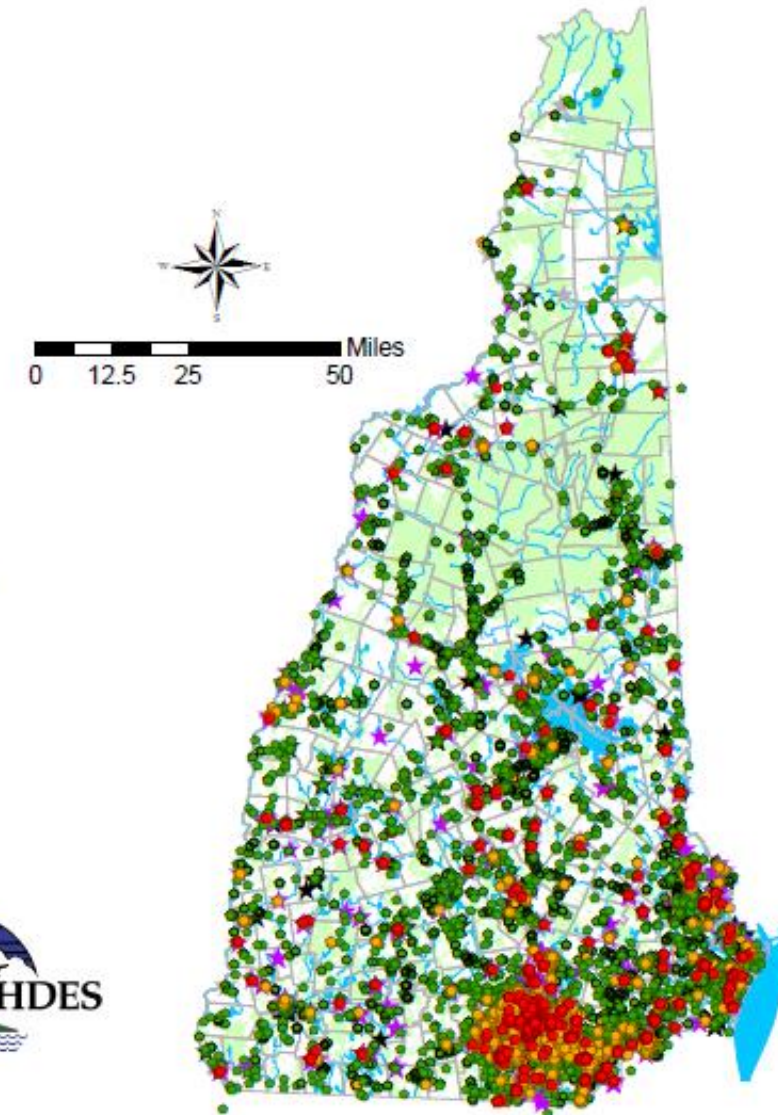
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## Looking to the Future

- Risk assessment of PFAS will *change with new research*.
- *These contaminants are not alone*, and recreational fishers should pay attention to advisories for other risks.
- *More basic and applied research is needed* to assess risks from dermal contact and inhalation (e.g., swimming and wading risks).
- *Local partnerships are helping* to address knowledge gaps.
- *Risk communication is critical*, especially with our affected communities, legislators and the regulated community.

Agency for Toxic Substances and  
Disease Registry's Partnership to  
Promote Local Efforts To Reduce  
Environmental Exposures



# APPLETREE



# Questions?

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Check out the NHDES PFAS Website (*changing soon!*)  
<https://www4.des.state.nh.us/nh-pfas-investigation/>

